

connection with the application.

Claims 1 and 2

In the Office Action, claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Gehera ('922) in view of Alexander ('792). Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Gehera, Alexander, and Emori et al. (Elect. Lett. 34:22(1998)). These rejections are respectfully traversed.

Claim 1 is directed to optical amplifier equipment that includes a Raman pump for producing Raman gain for optical data signals in a span of transmission fiber in a fiber-optic communications link. The Raman pump produces the Raman gain for the optical data signals using Raman pump light at first and second wavelengths.

An optical monitor is used to gather backscattered Raman pump light from the span of transmission fiber at the second wavelength.

A control unit uses the Raman pump and optical monitor to perform optical time-domain reflectometry measurements in a pump and probe arrangement. With this approach, the Raman pump light at the first wavelength serves as the "pump" and the Raman pump light at the second wavelength serves as the "probe." By modulating the Raman pump light at the first wavelength while

pulsing the Raman pump light at the second pump wavelength, the control unit can measure the effects of adjusting the Raman gain produced by the Raman pump light at the first wavelength in the span of transmission fiber.

A significant advantage of applicants' approach is that the same two wavelengths of Raman pump light that are used to produce Raman gain for the optical data signals during normal operation are also used as the "pump and probe" wavelengths during span characterization. This makes applicants' equipment less complicated than equipment in which extra sources are used to make characterizing measurements.

Nothing like applicants' claimed arrangement is shown or suggested by Gehera or Alexander.

Gehera describes an apparatus in which backscattered light from unspecified sources are used to make measurements in the Raman gain band or outside of the Raman gain band (see 150 and 160 in FIG. 1B of Gehera). Gehera also describes making measurements of back reflected light from a Raman pump (see 170 in FIG. 1B). However, Gehera says nothing about using a pump-and-probe arrangement of the type defined in claim 1 in which the pump and probe wavelengths are the same as the wavelengths used for generating Raman gain for the optical data signals in the span.

Alexander describes a signal-to-noise monitoring

arrangement that does not even mention the use of Raman pumps, much less Raman pumps having two wavelengths of light that are used in optical-time-domain-reflectometry pump-and-probe measurements. Alexander therefore does not make up for the deficiencies of Gehera.

Because neither Gehera or Alexander disclose or suggest applicants' claimed fiber-span characterization arrangement in which Raman pump light at first and second wavelengths is used in a pump-and-probe arrangement, claim 1 is patentable over Gehera and Alexander, whether these references are taken alone or in combination.


Claim 2 depends from claim 1 and is patentable because claim 1 is patentable.

Conclusion

The foregoing demonstrates that claims 1 and 2 are in condition for allowance. This application is therefore in

condition for allowance. Reconsideration and allowance of the application are respectfully requested.

Respectfully submitted,

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APPENDIX A TO REPLY TO NOVEMBER 6, 2002 OFFICE ACTION

This appendix presents the specification amendment that has been made in bracket-and-underline format.

The paragraph bridging pages 24 and 25 has been amended as follows:

During operation of module 20, control unit 40 may use tap 118 and monitor 120 to measure the Raman pump power. By using the measured Raman pump power for a given OTDR pulse and the calibration data stored in control unit 40, reflected OTDR signal measurements may be made accurately enough to determine the absolute value of the signals in trace 82 of FIG. 7, rather than just the relative trace shape. For example, control unit 40 may use the y-intercept value or extrapolated y-intercept value of trace 82 to measure the Rayleigh backscattering coefficient α_R at the pump wavelength. The ability to accurately measure the absolute value of the reflected signal assists control unit 40 in using measured values of P_R in characterizing span 16.

APPENDIX B TO REPLY TO NOVEMBER 6, 2002 OFFICE ACTION

This appendix presents the claim amendments that have been made in bracket-and-underline format.

Claims 12 and 15-17 have been cancelled.

Claim 1 has been amended as follows:

1. (Twice Amended) Optical amplifier equipment that amplifies optical data signals in a fiber-optic communications link that has at least one span of transmission fiber for carrying the optical data signals, comprising:

a Raman pump that produces Raman pump light [that creates] at first and second wavelengths to create Raman gain for the optical data signals in the span of transmission fiber, wherein the first wavelength is different than the second wavelength;

[a first] an optical monitor that measures [a first wavelength of] backscattered Raman pump light from the span of transmission fiber at the second wavelength; and

[a second optical monitor that measures a second wavelength of the backscattered Raman pump light that is different than the first wavelength of the backscattered Raman pump light; and]

a control unit that uses the Raman pump and the optical [monitors] monitor to perform optical time domain reflectometry measurements on the transmission fiber using a

pump and probe arrangement in which the Raman pump light at the second wavelength is pulsed to perform optical time domain reflectometry measurements while the Raman pump light at the first wavelength is modulated to measure the effects of adjusting the Raman gain produced by the Raman pump light at the first wavelength in the span of transmission fiber.